DIRECTED WORD CHAIN NETWORKS (PART 3)

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This is the third of a series of articles on directed word chain networks; the first two can be found in the August 1991 Word Ways. Specifically focusing on (8,4) word chains, it is divided into two sections. The first introduces a two-dimensional construction called a mesh; the second updates and extends Part 2, using an enlarged word list. All terms are defined in Part 1.

As described in Part 2, the original list of 2813 words containing 960 different frags was taken from a computerized Official Scrabble Players Dictionary database, augmented by a hand search of Webster's Second and Third and Chambers Twentieth Century Dictionary for eight-letter words suitable for long chains. Since the earlier article, further searches of Webster's Second (plus an exchange of lists with Christopher McManus) has resulted in a list of 6191 words (a 120% increase) with 1394 different frags (a 45% increase). Note how few new core frags accompany the large increase in words; the original search fairly well established the core. The frag types are tabulated below ("other" frags consist of preceders and followers, both defined in Part 1):

<table>
<thead>
<tr>
<th>frags</th>
<th>core</th>
<th>beginner</th>
<th>ender</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 2</td>
<td>960</td>
<td>507</td>
<td>119</td>
<td>142</td>
</tr>
<tr>
<td>Part 3</td>
<td>1394</td>
<td>659</td>
<td>205</td>
<td>181</td>
</tr>
</tbody>
</table>

Meshes

A mesh is a rectangular array of frags from word chains arrayed in rows and columns and interlocking in the manner of a word square. Below are samples of the largest meshes I could find using a microcomputer. Read the frags pairwise from left to right and from up to down; all eight-letter combinations are solid words. These large meshes have a more or less common theme, so only a few are shown. I was not quite able to complete any 6x6 meshes; both 4x9 and 6x6 meshes use 36 frags, but more intersection is required in the latter. Quite a few 5x7 meshes are possible.

fore-body-surf-fish-hold-over-long-hair-bird lower left corner
play-work-boat-tail-back-fire-wood-worm-seed alternates: side-lock, side-line, pipe-line, land-lock, land-line
down-hand-bill-head-wind-ball-cock-weed-like
town-wear-able-gate-ward-room-mate-less-ness
fore-hand-line-side-long-wool-ball
hold-fast-back-bone-wood-rock-weed lower left corner
over-land-wash-tail-wind-fish-hook
fire-lock-work-head-ship-worm-like alternate: cook-book
plug-hole-able-gate-ward-less-ness shop-lift
PART 3)

word chain
Word Ways, divided into construction 2, using an
word chain Word Ways, divided into construction 2, using an
word chain Word Ways, divided into construction 2, using an

over-fire-back-hand-play-room
tide-flat-foot-note-case-mate
long-tail-wind-blow-down-some
mark-land-rail-head-work-ship
tail-hand-play-room
hair-band-fish-line-side-wise
down-line-side-long-hand-load
slip-case-wood-work-head-like
turn-back-bone-tail-like-some
horn-book-land-ship-ward-walk
over-fire-wood-ward-walk-ways
bill-able-gate-ways outs
wind-fall-fish-able ies
fire-plow-foot-walk-outs-cent
fore-play-fool-rook-rose-leaf
wood-fish-hold-over-well-ring
take-down-land-fall-fish-worm
land-line-back-work-head-lock
over-hand-line-back-bone-wood
rail-side-wash-hand-load-able
slip-rail-side-band-work-shop
road-show-down-play-some-gate
knot-head-note-case-book-lift
book-case-weed-like-ways
horn-like-wise-weed-less

More than half a million 5x5 meshes can be constructed out of
my 6191-word database; a tiny fraction of these are listed in the
appendix. All of them shown have variations. Most meshes of any
size begin with fore or over and end with like or less converging
to ness; however, the appendix samples show a variety of begin­
ing (upper left) and ending (lower right) frags. The 5x5 format
is well-suited for showing such variety.

Updates

The one-way span of the (8,4) directed word chain network has
been reduced from 17 to 16, but otherwise has the same character.

Words arrayed r of a word
find using using to right and solid words
eme, so only 6x6 meshes; intersection is tible.
ft corner es: side-lock, e, pipe-line, e, land-line
corner
cook-book
shop-lift

Although it is possible to create very long (8,4) chains, it is
more challenging to find chains of a specific length between stated
ends. With a computer, I have gone one step further. In the following
word to ways chains, wordster, wordplay and wordbook are
used as often as needed, but otherwise no frag is repeated in this
set. The series is not optimized; a longer set is possible. Recogniz­
ing shipable, rockling, overshoe, and roadster, note how easy it
is to combine portions of these chains into one long one. Further­
more, new sections like hand-clap-trap-door-post-lude-rick-yard-
land, etc., can be inserted here and there.
Here are explanations of a few of my favorite eight-letter words:

1. a foreiron (Web 3) is not a golf club but part of a plow; a cockhead is not an upside-down cocktail but the stem of a grinding wheel; bearfoot (Web 2) is an herb; tailhead (Web 3) is the base of an animal's tail; burnover (Web 3) is an imperfectly-burned brick; hightide (Web 2) is a festival; a bookmate (Web 2) is a schoolmate; downgone (Web 2) means downcast or unhappy; gonesome (Web 2) means having a gone feeling; a workboat (Web 2) is indeed a boat; workship (Web 2) is a variation of workmanship; a landship (Web 3) is a large covered wagon; bookland (Web 3) is not a place to read books but the opposite of folkland (Web 3), a legal term regarding landholding; likewalk (Chambers) is an alternate of lykewake or latewake (Web 3), simply a wake; coneate or coneapt (Web 3) is a Mexican name for an animal commonly known as a hog-nosed skunk.

Part 2 gave a list of reversible words (such as bookcase and casebook). This list, given in the appendix, is now 150 words long with 91 different frags represented. All 91 frags are core frags and common four-letter words. 56 of these constitute a core with bidirectional links as in the standard Carrollian word network. This core is shown below; it has a span of 16.

```
<table>
<thead>
<tr>
<th>long</th>
<th>note</th>
<th>dove</th>
<th>skin</th>
<th>rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>case</td>
<td>book</td>
<td>ring</td>
<td>ship</td>
<td>shop</td>
</tr>
<tr>
<td>play</td>
<td>folk</td>
<td>head</td>
<td>fast</td>
<td>ward</td>
</tr>
<tr>
<td>wash-dish</td>
<td>land-</td>
<td>mark-down-</td>
<td>mate</td>
<td>turn</td>
</tr>
<tr>
<td></td>
<td>take</td>
<td>over</td>
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<td></td>
</tr>
</tbody>
</table>
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Other aspects of (8,4) chains are incorporated in the following two puzzles:

**PUZZLE 1:** Using only the 28 four-letter frags listed below, how
many 4x4 meshes can you construct? All eight-letter combinations must be listed as solid words in either Web 2, Web 3, OSPD or Chambers. A frag may not be used more than once in a mesh.

back ball band bell bone door dove fast fire fish hand head hold lady land like long ring ship side skin star tail wash weed wind wood worm

PUZZLE 2: Fill a blank with an eight-letter word so as to make two more eight-letter words. There might be more than one way to fill each blank. The frags of a fill-in word need not be words.

A. boat ______ ship  B. back ______ side  C. head ______ tail
 sample: tailwind stopover longhorn

D. bookmark ______ dingbats  E. pinafore ______ dateable

APPENDIX

backfall backfire backhaul backkick backstop bandtail barabara birdcage birthseed birdsong boilover bonefish bone tail bookcase bookland bookwork bootjack buckbush burnover burnside bushbuck bushwood cagebird caracara casebook chowchow coattail comedown conscious deerkill dishwash dividivi dovering downcome downface downplay downtake downturn downdash facedown fallback fallfish fastland folkland ganggang gangplow greegree hangover hardpans haulback haulover headlong headnote headtail headring headskin headwork hillside holdover hometown hookweed hotshots jackboot kavakava kickback killedeer kouskous landbook landfast landfolk landmark landwash lavalava likewise lineside lookpick longhead markland matamara mateship notehead overboat overburn overhang overhaul overhold overpass overslip overtake overrun overwalk overwing panshard passover picklock piripiri playdown plowgang pondfish railhead ringdove ringhead rootworm rootship shipward shopwork shotstar sideburn sidehill sideline skinhead slipover songbird starshot stopback tailband tailbone tailcoat takedown takeover ticktick townhome turndown turnover walkover wardship washdown washland weedhook wingover wiselike woodbush woodfish woodworm workbook workhand workhead workship workshop workroom woodroot woodworm
anti-king-head-wind-root pole-wood-land-ship-word star-fish-line-side-walk ring-tail-back-wash-outs neck-band-work-hand-wear
even-down-turn-tail-race
hand-hold-over-head-line
bill-back-land-rail-side
fish-wood-wind-road-show
wife-ward-ship-work
burn-over-crop-land-sick
side-long-head-ward-room
wash-hand-work-ship-eate
down-play-book-worm-less
gone-some-wise-like-ness
deer-hair-line-side-ward
horn-tail-back-wash-room
fish-bone-wood-work-some
bolt-head-note-book-wise
rope-band-case-worm-wood
home-body-surf-fish-wife
life-work-boat-tail-ward
long-hand-bill-head-ship
hair-line-back-band-worm
wood-side-spin-ster-ling
bear-foot-back-band-case
wood-work-hand-fish-wood
cock-coat-bill-book-weed
bell-tail-head-land-like
wind-ward-ship-side-walk
blue-wing-over-land-lock
cock-tail-back-wash-down
head-band-work-hand-play
note-case-book-rest-ward
shee-fish-hold-over-ward
ring-tail-back-hand-play
side-bone-wood-work-some
long-head-land-book-wise
hair-lock-wire-worm-wood
shee-fish-hold-over-band
ring-tail-back-door-bell
side-band-work-head-wind
show-case-book-land-ward
lace-wood-shop-mark-note
hand-blow-down-play-date
hold-back-wash-work-book
over-fire-tail-head-land
long-wood-wind-ring-lock
root-ward-ship-side-step
wild-fire-plow-foot-note
wood-fall-back-band-case
rock-fish-boat-work-book
hair-tail-ship-ward
bell-wind-ring-ship-ling
down-fall-fish-pole-star
line-band-ship-ward
wash-work-head-ring-bird
hand-band-note-wise-weed
over-king-fish-pole-star
fire-side-bone-wood-wood
back-wash-tail-wind-ling
wash-work-head-ring-bird
hand-band-note-wise-weed
bell-fish-hold-over-ward
pipe-line-back-work-book
wood-side-bone-land-head
land-wash-tail-wind-ring
lock-down-ward-ship-lets
bell-tail-bone-head-boat
wind-pole-wood-land-mark
fish-line-side-wash-down
hold-back-band-work-hand
over-door-case-book-rest
side-flat-long-hair-man
land-iron-head-bone-wood
slip-back-wind-fish-wood
over-hand-blow-line-side
pass-book-case-work-wise
chee-king-fish-wood-root
ring-side-bone-wood-wood
head-long-tail-wind-ship
land-line-back-fall-ways
wire-work-hand-out-sides
anti-slip-over-fall-fish
type-form-feed-back-wood
face-work-head-land-wind
down-hand-ship-side-burn
pipe-line-like-talk-able
draw-stop-over-wind-sail
tube-hand-work-fish
rose-head-line-back-bone
bush-land-side-wash-ship
fire-lock-step-down-ship
farm-hand-play-down-turn
land-line-back-ship-side
iron-side-bone-wood-wood
head-long-tail-ship-root
ring-neck-band-fish-hold
hair-line-side-wash-down
slip-back-band-work-hand
over-fire-tail-head-land
long-wood-wind-ring-bird
wood-rock-fish-wood-seed
blow-down-hold-over-ship
fish-line-back-work-book
wood-side-bone-land-head
land-wash-tail-wind-ring
lock-hole-able-gate-ages
bush-land-iron-side-show
wood-fall-back-wash-down
wind-fish-bone-tail-ship
ring-bolt-work-head-line
lock-hole-able-gate-ages
cape-line-back-down-hold
ring-side-wash-band-fast
bone-head-wood-book-land
wood-wind-ship-wood-like
grub-root-ward-less-ness
sand-blow-iron-head-work
fish-line-side-long-some
hold-back-bone-tail-ship
over-fire-wood-wind-ward
live-trap-rock-fall-ages